O REPORTING HAZARDOUS SUBSTANCE ACTIVITY WHEN SELLING OR TRANSFERRING REAL PROPERTY

1 Background

The General Services Administration (GSA) amended the Federal Property Management Regulations (Subchapter H) to provide procedures for reporting excess Government-owned property on which there was hazardous substance activity. This amendment implements the Environmental Protection Agency regulations Reporting Hazardous Substance Activity When Selling or Transferring Federal Real Property (40 CFR 373).

2 Summary of Requirements

a Section 101-47.202-2 of Amendment H-180 to the GSA property regulations was revised to include the following requirements:

(1) Agency reports of excess real property are to include information concerning any hazardous substance activity, as defined by 40 CFR 373, which took place on the property. Hazardous substance activity includes situations where any hazardous substance was stored for 1 year or more, known to have been released, or disposed of on the property.

(2) The reporting agency must include information on the type and quantity of such hazardous substance and the time at which such storage, release, or disposal took place.

b Section 101-47.203-7(h) requires transferor agencies to provide to the transferee agency all information held by the transferor concerning hazardous substance activity as outlined in Section 101-47.202-2.

c Section 101-47.304-14 and 101-47.307-2(d) requires that where the existence of hazardous substance activity has been brought to the attention of the disposal agency, the disposal agency shall incorporate such information into any Invitation for Bid/Offers to Purchase and any deeds, leases, or other instruments executed to dispose of the property.

O REPORTING HAZARDOUS SUBSTANCE ACTIVITY WHEN SELLING OR TRANSFERRING REAL PROPERTY (Continued)

d The disposal agency must include a Notice of Hazardous Substance Activity Statement indicating that the Federal Government has taken all remedial action necessary to protect human health and the environment with respect to the hazardous substance activity during the time the property was owned by the United States and that the Federal Government will conduct any additional remedial action found to be necessary with respect to any substance remaining on the property.

For specific details refer to Chapter II, Disposal of Real Property and Related Personal Property, ARS Manual 245.1, Real Property Manual.

3 Environmental Site Assessments

(Reserved)

P TYPES OF PERMITS REQUIRED

1 The following list gives several examples of the types of permits which may be required for ARS facilities and operations.

Type of

operation or facility Type of Permit Agency

o Underground storage o Permit to install State

tanks o Permit to use or EPA

o Storing, treating, o RCRA permit State

or disposing or EPA

hazardous waste

o Transporting H.W. o Registration EPA or

number State

o Hauler license or State

permit

o Generating H.W. o Identification State

number or EPA

o Landfilling o Permit to operate State

o Underground o Permit to dump EPA

injection for

waste disposal

P TYPES OF PERMITS REQUIRED (Continued)

o Potable water o Permit to operate State

treatment

o Wastewater o Sewer use permit Local

discharge to sewer

o Offsite discharge o NPDES permit EPA or

of wastewater State

o Incinerator o Air pollution State

permit

o Stationary air o Permit to construct State

pollutant source or modify source or EPA o Permit to operate

o Pesticide use o Experimental use EPA or

permit State

o Applicator's license

o Well construction o Permit to construct State

or water withdrawal o Permit to operate

o Endangered species o Recovery Plan USFWS

Q PUBLIC RELATIONS

This is another area in which hazardous waste can become a problem. Given the potential for hazardous waste accidents, and stories about problems like Love Canal, it is not surprising that communities are sensitive about chemicals transported on their streets or stored nearby. People may appreciate an ARS activity for its contributions to their local economy, but they will still be concerned about how that installation carries out its mission. Thus, any ARS activity that handles hazardous wastes may have a future public relations problem if those wastes are not properly managed.

The same applies to even the perception of violating other environmental laws and regulations. Public reaction may seem neither rational nor informed, although it is a predictable response in the absence of credible information.

Should an ARS Area or Location be contacted by a member of any news media (e.g., radio, paper, television, etc.) concerning any "environment- or public health-related situation", refer the inquirer to the USDA/ARS Office of

Q PUBLIC RELATIONS (Continued)

Information for information and guidance. Concurrently, the next higher ranking ARS official should be contacted. Conversations and actions should be documented.

R LABORATORY WORK PRACTICES

1 Laboratory workers are often exposed to a great variety and unique types of potential hazards. Therefore, more precautions must be taken in laboratories than in other workplaces. For example, laboratory work can involve the use of chemicals or reactions of unknown hazard potential, or it can involve exposure to substances that are known to be extremely toxic (e.g., carcinogens). However,

laboratories usually handle only small amounts of material at any one time, and exposure to these substances is usually limited to a short time duration. It is obvious that a great need exists for an effective and mutually shared safety and health program in the laboratory.

2 General Recommendations

There are several principles of safe laboratory practice that every laboratory worker should follow.

a Prior to the start of any work assignment, learn the safety protocols and procedures necessary for that operation.

b Use the personal protective equipment provided.

c Know the emergency evacuation procedures.

d Follow proper hazardous waste disposal procedures.

e Never pipet by mouth.

f Observe all warning signs.

g Label all chemicals, reaction containers, test tubes, etc.

h Avoid working alone, whenever possible.

i Enroll in the Occupational Maintenance Program.

R LABORATORY WORK PRACTICES (Continued)

j If there is ever a question as to the safety or health of a situation do not proceed without requesting assistance. Ask questions first and avoid accidents.

k Supervisors should take disciplinary action when safety/health principles are willfully or continuously ignored by subordinates.

3 Toxicity, Corrosive, Flammable, and Combustible Materials

Many chemicals in the laboratory are toxic, corrosive, flammable, combustible, or can be placed in several of these categories. All substances have the potential to be toxic. Toxic substances can cause serious damage or interfere with cellular metabolism. Acutely toxic substances can cause

damage from a single exposure. The exposure can be either high or low dose (dose is dependent on toxicity), but the duration of the exposure is always short (minutes to several hours). Chronically toxic materials cause damage from repeated exposures over a long period of time. Hydrogen cyanide, hydrogen sulfide, and carbon monoxide are examples of chemicals which are acutely toxic. All carcinogens and many metals (e.g., lead, mercury) are chronic toxins.

Corrosive materials erode or burn other substances. Corrosives include strong acids and bases, dehydrating agents, and oxidizing agents. Although many corrosives are toxic, they usually exert damage by means of their physical characteristics. For example, a few drops of a concentrated acid can cause a severe burn, however, no illness necessarily results from direct exposure to acid.

By definition, a flammable liquid is any liquid which has a flash point below 100F (37.8C) and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100F (37.8C). There are several subdivisions of flammable liquids as defined by the National Fire Protection Association (NFPA):

Class IA - Having flash points below 73F (22.8C) and having a boiling point below 100F (37.8C).

Class IB - Having flash points below 73F (22.8C) and having a boiling point at or above 100F (37.8C).

Class IC - Having flash points at or above 73F (22.8C) and below 100F (37.8C).

The flash point of a liquid is the lowest temperature at which sufficient quantities of vapor are given off that when ignited a flame will be propagated away from the ignition source.

Combustible liquids have flash points at or above 100F (37.8C). The NFPA divides combustibles into the following classes:

Class II - Having flash points at or above 100F (37.8C) and below 140F (60C).

Class IIIA - Having flash points at or above 140F (60C) and below 200F (93.4C).

Class IIIB - Having flash points at or above 200F (93.4C).

The principal routes of exposure to toxic substances in the laboratory are:

a Inhalation

b Ingestion

c Skin absorption

d Injection

Inhalation of toxic vapors, fumes, mists, dusts, etc. occurs when laboratory fume hoods are not used or not used properly. Ingestion of toxic substances is an insidious problem in the laboratory environment. All too often eating and drinking are allowed at work stations. Very few laboratory workers take the time to wash their hands prior to drinking a cup of coffee, or smoking a cigarette. Many toxic substances, especially organic solvents, are readily absorbed through the intact skin. Use of protective gloves and/or barrier creams can help

R LABORATORY WORK PRACTICES (Continued)

prevent exposure to chemicals via skin absorption. Accidental self-inoculation is perhaps the number one personal injury in the laboratory.

Working with known or suspected carcinogens requires very stringent protocols and procedures. The Occupational Safety and Health Administration (OSHA) currently has standards for working with several known human carcinogens. Although these standards were written for general industry, and not specifically for laboratories, many of the sections, especially those on labeling and personal protective equipment, are valid for use in the laboratory.

For working with substances of moderate chronic or high acute toxicity, the following procedures should be used as guidance.

o Consult standard references that list the toxic properties of the substances to be used, prior to start-up of any procedure.

o Always wear a lab coat or another type of protective cover while working in the laboratory. Remove the lab coat prior to leaving the laboratory.

o Wear protective gloves and/or use barrier creams to avoid skin absorption of chemicals.

o Procedures involving toxic substances that may create aerosols should be performed in a fume hood. The face velocity of the fume hood should be 80-100 linear feet per minute.

o Never eat, drink, smoke, chew gum, or apply cosmetics in the laboratory. Never store food or drinks in the refrigerators containing chemicals or other experimental substances. Wash hands and arms after working with toxic substances.

o Chemical inventories should be established and maintained.

o Properly dispose of all waste products. Many chemicals can be decontaminated, inactivated, etc. and poured down the drain. Consult a reference prior to proceeding.

R LABORATORY WORK PRACTICES (Continued)

o Waste products should be stored in closed, impervious, and properly labeled containers.

o For working with substances of known high chronic toxicity, these following precautions should be taken in addition to those already listed for substances of moderate chronic or high acute toxicity.

o Procedures and protocols for working with these substances should be reviewed in advance by the location safety representative, the safety health committee or the Area Safety and Health Manager.

o The chemical inventory should be carefully supervised, with a strict sign-in, sign-out procedure.

o Ventilated storage should be used for all volatile chronic toxins. The storage cabinet or room should be vented to the outside of the building or into a fume hood. All primary containers should be placed into secondary

containers large enough to contain the contents of the primary container in case of leakage or breakage. All storage areas should be posted and have limited access to only authorized personnel. Storage rooms should be designed to be maintained under negative pressure with respect to hallways or other rooms.

o All containers should have extra labeling warning of the toxic potential of the contents.

o All work involving the use of the substances should be performed in an area designated for that purpose only.

o Glove boxes should be pressure tested and meet all of the manufacture's specifications prior to use.

o Workers should enroll in the Occupational Health Maintenance Program.

R LABORATORY WORK PRACTICES (Continued)

4 Procedures for Working With Flammable Hazards

A large majority of the chemicals found in laboratories are flammable. The flammability of a substance is determined by its vapor pressure, flash point, and ignition temperature. It is important to remember that a flammable liquid itself does not burn. The emitted vapors are what actually burn. Numerous accidents have occurred from leaving an open container of a flammable liquid on a lab bench just a few feet from an ignited bunsen burner. Natural drafts cause the emitted vapor to travel to the flame and a fire ensues.

Guidelines for working with flammable substances include:

o Never handle or store flammable substances near an ignition source (open flames, electrical equipment, burning tobacco).

o Never use an open flame to heat flammable substances. Heating jackets, water baths, etc., are preferred.

o Bonding and grounding should always be used when transferring flammable liquids to or from metal containers.

o Proper ventilation is an absolute necessity. When large quantities of substances are handled or stored, a good exhausting system must be used. A fume hood is essential for working with small quantities.

Compressed or liquified gases pose a potential hazard which is often overlooked. Increased temperature, usually due to fire, can cause leakage from the cylinders which can result in the development of an explosive atmosphere.

Flammable or self-igniting dusts are a potential hazard in the laboratory. When mixed with air, oxidizable particles can cause potent explosive mixtures. Aluminum fines, magnesium powder, zinc

dust, flowers of sulfur, and grain dusts are examples of flammable or self-igniting dusts.

Various substances commonly used or produced in the laboratory are potential explosive hazards due to their sensitivity to mechanical shock and light. Organic peroxides, organic nitrates, and azides and other nitrogen-containing compounds are examples of shock-sensitive substances.

Organic peroxides are probably the most dangerous substances used in the laboratory. They are extremely unstable and sensitive to sparks, shock, vibration, and temperature extremes. Due to their uneven decomposition process, some organic peroxides can self-ignite. The decomposition of ethyl ether produces an organic peroxide commonly found in laboratories. It is not unusual to find ethyl ether stored along with other chemicals in the average laboratory chemical storage facility. These cans are usually rusted and sometimes swollen. Removal of these containers is imperative, but must be approached with extreme caution. The safety representative should be contacted immediately. Other precautions for handling organic peroxides include:

o Handle and store the minimum necessary quantity of organic peroxides.

o Vermiculite can be used to clean up spills.

o Unused or unnecessary organic peroxides should be disposed of properly, and not stored for an undetermined future use.

o Only ceramic, glass, or wooden tools and containers should be used. Metal tools can cause sparking. Glass stoppers and glass containers with screw-caps should not be used.

o Never use near flames or heat sources. No smoking signs should be posted and obeyed.

o Storage of organic peroxides is very tricky. Cold storage is usually recommended; however, some mixtures become more shock sensitive if too lose to its freezing point. Prior to storage

of any organic peroxide, a chemical storage reference should be consulted.

R LABORATORY WORK PRACTICES (Continued)

When working with potentially explosive compounds, the following personal protection equipment is recommended:

o Clear safety glasses with side shields, or goggles, and a face shield.

o Heavy-duty gloves, not surgical-type gloves.

o Lab coats made from natural fibers. The use of synthetics will increase the possibility of injury if fire occurs.

5 Procedures For Working With Compressed Gas

When a regulator valve is sheared off of a compressed gas cylinder, the sudden release of pressurized gas turns the cylinder into a dangerous projectile that can penetrate concrete walls. The gas which fills the room presents other hazards of fire, explosion, asphyxiation, and/or other toxic effects. There are several useful guidelines to follow for the safe usage and handling of compressed gas.

o All cylinders should be labeled as to content and condition (full or empty). The use of color coding is not recommended, because cylinder colors can vary according to supplier.

o Empty cylinders should be stored separately from those in use or full cylinders in storage. They should always be stored upright. Empty cylinders are never totally empty, small quantities of gas will remain, as well as, the packing in the bottom. The packing often

contains a volatile liquid which can leach out if the cylinder is stored on its side.

o If gases are manifolded, they should be checked for compatibility and the lines labeled.

o Belts or chains should be used to secure cylinders. One belt or chain per cylinder is preferred to grouping of several cylinders.

o Regulator valves should be easily accessible, but secured from potential shearing.

o The main valve of a full cylinder should never be completely opened, and should never be opened without a regulator valve attached.

o Only inspected and approved regulator valves should be used.

6 Handling of Liquified Gases and Cryogenic Liquids

Destruction of living tissue, and fire and/or explosion, are the primary potential hazards associated with the use of liquified gases and cryogenic liquids. Acetylene hydrogen and methane are known for their fire and/or explosive potentials. Increased oxygen content readily increases the flammability of combustible substances and sometimes causes noncombustibles to burn. If handled properly, the hazard potential of liquified gases and cryogenic liquids is minimal.

o Cold burns can be equally as serious as thermal burns. Therefore, protective gloves should always be used. The gloves should be impervious to the fluid.

o A face shield should be worn at all times.

o Proper ventilation is necessary to prevent inhalation of the emitted vapors.

o Thermal expansion can cause the cylinders to rupture. Therefore, it is not advisable to fill containers to more than 80% of their capacity.

o All containers should be fitted with spring-loaded pressure-relief devices.

7 Vacuum Systems

Working with vacuum systems presents the potential hazard of implosion. Implosion results from a break in the system, because the pressure is higher on the outside than on the inside. The result of an implosion can be flying glass and chemicals. The splattered chemicals can cause a fire, explosion, or toxic/corrosion hazards to the worker. A few carefully followed guidelines will aid in lessening the possibility of implosion.

o When working under vacuum conditions, confine the operation to a secure area of the laboratory (e.g., fume hood).

o Always wear a face shield.

o Carefully examine all glassware prior to use for cracks, scratches, etc. Never use damaged or repaired glassware in a vacuum apparatus, it is subject to thermal shock.

o A proper cold trap should always be used to prevent the material under vacuum from being drawn into the vacuum system.

o Dewar flasks are often used in vacuum systems. These flasks are designed especially for this use, but are very susceptible to thermal shock and implosion. Some type of shielding should be used when working with Dewar flasks. Most frequently, they are shielded by the application of friction tape.

8 Personal Protective Equipment and Clothing

When working in a laboratory it is essential for every worker to use the personal protective equipment and clothing provided. The first instructions a worker should receive prior to starting work in a laboratory are on the types and directions for use of these items.

a General Guidelines

o Each laboratory worker should be supplied with lab coats. Lab coats should be worn at all times when in the laboratory, unless another type of protective coverall is required.

o Loose, flowing, and skimpy types of clothing should not be worn. Clothing made of natural fibers is preferred. Nylon stockings are unadvisable. They tend to be very reactive to many of the chemicals in the laboratory, and therefore, can contribute to increased injury from a chemical spill.

o Sandals and bare feet should be prohibited. Sneakers are not advised.

o Rubber aprons, gloves, and boots should be supplied and used for working with corrosives.

o Long hair should be restrained.

b Eye Protection

o Safety glasses should be worn at all times in the laboratory.

o The use of contact lenses should be prohibited, except when needed for special medical purposes. If contacts are worn, safety glasses must, also, be worn. Many accidents are recorded of contact lens wearers splashing organic solvents in their eye, the lenses react with the solvent and can produce permanent damage, including blindness.

o Many safety glasses can be fitted with side shields. However, goggles and splash shields are preferred for working with potential splash hazards.

o Visitors should be provided with safety glasses before entering the laboratory.

c Gloves

o The use of gloves for all laboratory procedures should be encouraged. The use of protective gloves for working with corrosive or highly toxic substances should be mandated.

o The appropriate gloves should be selected according to the substances that will be handled. It is essential that the gloves to be used are impermeable to the substances being handled. Most gloves are only impermeable for limited exposures. Sometimes it is necessary to wear two pairs at the same time.

o Reusable gloves should be inspected for discoloration, holes, and tears, prior to each use. Gloves should, also, be checked at frequent intervals during use. Disposable gloves should be used once and disposed of properly.

o Gloves made of asbestos are often found in laboratories. These gloves do not present a health hazard provided they are in good condition. Torn or frayed asbestos gloves should be disposed of as any other asbestos-

containing material. There are many new materials on the market which are good replacements for asbestos. Newly purchased gloves should be constructed of one of these materials.

d Respiratory Protective Equipment

o The use of respiratory protective equipment is becoming more common in laboratories. Their primary use is for the protection of the allergic worker. It is essential to choose the appropriate respirator for the conditions. Detailed instructions are provided by many manufacturers.

o Each employee must be properly trained, and fitted in the use of personal respiratory protective equipment prior to being allowed to use it.

o Surgical masks do not provide the appropriate protection to the worker; rather they are used to filter the exhaled air of the wearer. These masks can be effective to protect workers from animal hair (not dander). However, this application is limited. Dust masks, which sometimes look identical to surgical masks, are more appropriate.

o Any questions concerning the selection or use of respirators should be directed to the ASHM Industrial Hygienists.

R LABORATORY WORK PRACTICES (Continued)

9 Laboratory Safety Equipment

All laboratories should be supplied with eye wash stations, safety showers, fire extinguishers, and a fire alarm/emergency system. First-aid supplies and trained employees should be in close proximity to each laboratory. An emergency evacuation plan should be developed and distributed to all Location employees and posted with numbers and specific emergency procedures. Drills should be practiced frequently. In those instances where sudden building evacuation will cause a severe interruption with the research or will result in a break in containment, the drills should be announced in advance. Instead of actual building evacuation, employees can be assigned an emergency reporting station where they are to go in the event of an emergency. Preannounced drills can be arranged to occur prior to the start of the day's activities.

a Eye Wash Stations

o Eye wash stations should be installed in close proximity to all areas where work is performed with chemicals.

o Eye wash stations should be of the type which are permanently installed and which have a continuous water flow.

o Eye wash bottles can be used as an interim measure, but cannot be used permanently instead of fixed stations.

o All eye wash facilities should be inspected at least monthly for proper operation.

o Special solutions are not necessary, or recommended, for eye wash bottles.

b Safety Showers

o Safety or deluge showers should be installed in close proximity to all chemical areas. (Maximum distance should not exceed 20 feet.)

R LABORATORY WORK PRACTICES (Continued)

o Where chemicals are stored outside, a drench hose can be used instead of a shower.

o The pull handles on the showers should be of solid construction and not metal links.

o Showers should be carefully placed so that they are accessible to the handicapped.

o Once the water flow is started, it should be continuous without holding on to the pull handle.

c Fire Extinguishers

o Each laboratory should have at least one multipurpose dry chemical fire extinguisher mounted in a readily accessible place (preferably at the entrance-way to a workplace/laboratory). These extinguishers are useful for small fires of any type. However, this type of extinguisher leaves a powdery residue which is difficult to clean up and can damage delicate electronic equipment.

o Fire extinguishers of any type, are meant to be used for small fires only. In the event of a large fire the building should be evacuated.

o Fires of flammable and combustible substances are difficult to put out. The use of water on these substances sometimes causes the fire to spread because the density of most of these substances is lighter than water and they will float on top.

10 Laboratory Ventilation

Two types of ventilation are usually found in laboratories: general or dilution ventilation; and local ventilation. Dilution ventilation is the normal air exchange that occurs inside a building which is provided by the heating and cooling

systems. Local ventilation is the additional air supplied in a small area specifically designed to move larger quantities of air over a short period of time. All laboratory hoods are examples of local ventilation designs. The general ventilation in a room is usually measured as room changes of air per hour. Typically, 8 - 12 room changes of air per hour provide adequate dilution ventilation.

The primary use of laboratory hoods is for working with highly toxic and volatile chemicals. An important use of these hoods that is often overlooked is for highly reactive experiments. If the sash is closed it acts as a physical barrier between the worker and the potential hazard. Laboratory hoods should never be used for storage. Further details on laboratory fume hoods can be found in Chapter V ARS Laboratory Fume Hood Standards of Section C - ARS Industrial Hygiene Function of this manual.

S CHEMICAL STORAGE, HANDLING, AND LABELING

1 Introduction

Safe and healthful laboratory work practices begin with proper chemical storage, handling, and labeling. This is, perhaps, the most overlooked hazard in the laboratory. Improper storage of chemicals has and can cause spontaneous combustion resulting in a series of explosions and fire which can destroy human life and property. It can also cause unnecessary exposure to hazardous airborne levels of toxic substances.

2 Elements of Proper Chemical Storage

There are several common sense rules to follow for properly storing chemicals:

o Do NOT store chemicals on a strict alphabetical basis.

o Store dry chemicals separately from liquids. Separate, non-adjacent storage rooms are preferred. In the laboratory, liquids can be kept in separate cabinets.

S CHEMICAL STORAGE, HANDLING, AND LABELING (Continued)

o Separate organic chemicals from inorganic chemicals.

o Separate oxidizers from reducers. Commonly used oxidizers include oxides, peroxides, perchlorates, chlorates, chromates, dischromates, nitrates, nitrites, bromates, and permanganates.

o Store dry and liquid chemicals separately, by class.

- Solvents

- Flammable/combustible

- Acids

- Bases

- Aqueous

- Water sensitive (e.g., metallic sodium and potassium, metal hydrides)

- Compressed gases

- Pesticides

o Do NOT store large quantities of chemicals in the laboratory. One day's worth is usually recommended; however, this is sometimes impractical. No more than one week's worth of flammable/combustible material should be stored in a laboratory, except where approved by the Safety Representative or Safety Committee. Large quantities of flammable/combustible materials should be stored in a safety cabinet.

o Do NOT save old chemicals. It is common practice in laboratories to save chemicals because they might be needed "some day". This reasoning may be practical for some dry chemicals with lengthy shelf-lives; however, for organic solvents it is a senseless and dangerous practice. Usually when a new project is started, organic solvents from the same lot are required, a few containers from a different lot will be kept for "future" use. As the storage area becomes more crowded with "saved" chemicals, the risk of something untoward happening increases. Most organic solvents degrade fairly rapidly even in closed containers, as they contain quantities of air

from packaging at normal room conditions. Some organic solvents become very unstable as they degrade (e.g., peroxide formers), and a sudden jarring or change in temperature can cause a violent reaction resulting in an explosion and fire.

o Always label every container.

o Keep chemicals in their original containers whenever possible.

o An inventory should be made of all chemicals. This inventory should be updated on a regular basis.

o Carcinogens, highly toxic substances, and controlled substances should be stored in secured (locked) areas. Access to these substances should be limited to trained, authorized personnel.

o Storage facilities and cabinets:

- Bulk quantities of chemicals should be stored in separate storage facilities. Different classes of chemicals should be stored in separate rooms with appropriate fire extinguishing systems. For example, water sensitive chemicals should never be stored near water extinguishers and/or sprinkler systems. At the same time, special emphasis should be placed on the correct location of emergency showers and eye wash stations, and decontamination facilities.

- Flammable and combustible materials should be stored in a separate building whenever possible to lessen the potential hazards in the event of fire.

- When a storeroom for flammable/combustible materials must be located inside a laboratory building it should be in an area which is easily accessible for fire fighting; usually, on the first floor at the end of a hallway. This room must meet the requirements of the National Fire Protection Association (NFPA) Standard No. 30, Vol. 3

(Flammable and Combustible Liquid Code) and any subsequent amendments or changes.

- Within the laboratory, all flammable/combustible materials should be stored in NFPA approved flammable storage cabinets. Care should be taken not to over-stock these cabinets. An over-stocked cabinet loses its fire rating and can become an extremely dangerous hazard.

- <ins>Never</ins> store other types of chemicals in a flammable storage cabinet.

- Care should be taken in the placement of a flammable storage cabinet. It should not block aisles or doorways; preferably they should be placed near windows for easier fire fighting access.

- Most laboratories have storage cabinets made of metal. However, properly constructed wooden flammable storage cabinets have been shown to withstand fire better than their metal counterparts. (See NFPA 30 Vol. 34 - 3.2.2.)

- Prior to use of a flammable storage cabinet, the flame arrestor screens should be checked. These screens are an essential part of the cabinet's resistance to fire.

o Drum Storage

- All drums should be stored with a pressure relief device installed.

- Appropriate care should be taken to keep drums containing flammable/combustible materials separated from other drums, and placed in a cool and well ventilated area.

- All drums containing flammable/combustible materials must be properly grounded and bonded, when dispensing to small safety containers.

S CHEMICAL STORAGE, HANDLING, AND LABELING (Continued)

3 Elements of Proper Chemical Handling

Handling chemicals properly is a matter of common sense and caution.

o Always read the label prior to the use of any chemical, even if it is used every day. Many chemicals have similar names, but very different properties.

o No matter how small a spill may appear, it should be cleaned up immediately. Spill kits should be convenient to every laboratory.

o Use laboratory fume hoods for handling all volatile and highly toxic substances. Occasionally, glove-boxes can be properly fitted and used as a substitute when hoods are not available.

o Never smoke, or use a flame or sparking ignition source when handling flammable/combustible materials. Post the work area when these materials are in use.

o Never mix chemicals unless the resulting reaction is known, or unless all precautions are taken to contain the reaction in an explosion-proof environment.

o Dispose of all chemicals properly. (Reference waste handling section.)

4 Elements of Proper Labeling

Proper labeling of chemicals is required by law in some states and eventually will be required by OSHA. The basic information necessary on a label to comply with legal and good laboratory work practice recommendations is:

o The Chemical Abstract Service Number (CAS #), or the NIOSH number.

o The chemical name of the substance.

o The generic name of the substance.

o Lot and catalog numbers.

It is important to note that a mislabeled container or unnamed product can be traced by the use of the manufacturer's name and catalog number.

5 References

a Prudent Practices for Handling Hazardous Chemicals in Laboratories, Committee on Hazardous Substances in the Laboratory, Assembly of Mathematical and Physical Sciences, National Research Council, National Academy Press, Washington, D.C., 1981.

b Guide for Safety in the Chemical Laboratory, 2nd. ed., Safety and Fire Protection Committee of the Manufacturing Chemists Association, Van Nostrand Reinhold Company, 1972.

c Handbook of Reactive Chemicals , 2nd. ed., L. Bretherick, Ann Arbor Science, 1979.

d Material Safety Data Sheets.

e Safe Handling of Chemical Carcinogens, Mutagens, Teratogens and Highly Toxic Substances, Vol. 1 & 2, D. B. Walters, ed., Ann Arbor Sciences, 1979.

f Handbook of Laboratory Safety, Norman V. Steere, ed., The Chemical Rubber Company, Cleveland, Ohio, 1967.

T BIOHAZARDS AND THEIR CONTROL IN THE LABORATORY

1 Objectives

The three essential elements of biohazard control in the laboratory are: (a) to protect the laboratory worker from infection, (b) to insure the integrity of the experimental studies or clinical tests being carried on, and (c) to protect the surrounding community from infectious agents being studied.

a The first and most important aspect of a biological laboratory safety program, the protection of the laboratory worker, will be covered in detail. Primary emphasis will be given to the use of proper laboratory techniques and safety equipment.

b The importance of protecting the integrity of experimental studies or clinical procedures being carried on in a biological laboratory cannot be overemphasized. Cross contamination in laboratory tests or cross infection in a group of experimental animals not only wastes many man hours, but may result in the publication of misleading information, the release of contaminated vaccines, or the infection of laboratory personnel. When working with disease agents noninfectious for man, one is tempted to be less cautious than with those agents which are potentially hazardous to man. Good laboratory procedures should be followed at all times.

c Every effort should be made to prevent the escape of infectious agents from the laboratory. Systems for treating sewage, either with chemicals or heat, should be employed. Exhaust air from contaminated buildings should be filtered or heat sterilized. Infected animals should not leave the premises. Proper procedures for personnel entry and exit should be established to minimize the possibility of agent escape on personnel or their clothing. Controlled methods for receiving and shipping equipment and materials to and from the laboratory should be established.

T BIOHAZARDS AND THEIR CONTROL IN THE LABORATORY (Continued)

2 Management of Biological Laboratory Safety Program

Phillips and Jemski[1] list several suggestions for proper management of biological laboratory safety programs. Their suggestions are directed toward the focal point of laboratory safety--the laboratory worker. They include the following:

a Establish written safety regulations which are read and understood by all.

b Keep safety needs in mind when screening and selecting new employees.

c Train each new employee until certain that he understands the rules and why.

d Insofar as possible, design safety into techniques and procedures as they are developed.

e Establish responsibility for safety. Each supervisor should be responsible for the safety of his people, but each employee should have a personal responsibility--safety should be a part of every job.

f Establish a reporting system for accidents, loss-time injuries, and laboratory-acquired infections and insist on prompt reporting.

g Investigate each accident and illness to determine what can be done to prevent recurrence.

h Encourage workers at all levels to suggest means of eliminating laboratory hazards.

Safety, in its proper perspective, cannot be separated from laboratory techniques or procedures. In a real sense, it is an attitude or frame of mind. No technique, procedure, or piece of equipment should be accepted until it is safe. If it is right, it is safe.

An integral part of any well-rounded laboratory safety program includes a continual check on the health and well-being of all workers. A comprehensive medical history and physical examination should be required at the time of

employment. Reference serum samples collected at this time are frequently helpful in establishing an early and accurate diagnosis of any subsequent laboratory-acquired infection.

Immunization for agents under investigation should be provided when warranted and available. Personnel with predisposing physical problems should not be employed in hazardous areas. Pregnant employees should not be allowed to work in virus laboratories.

3 Biological Laboratory Safety Regulations

Wedum[2] has prepared an excellent list of laboratory regulations applicable for work with infectious agents. They are as follows:

a There will be no direct mouth pipetting of infectious or toxic fluids.

b Pipettes will be plugged with cotton.

c No infectious material will be blown out of pipettes.

d No mixture of infectious material will be prepared by bubbling expiratory air through the liquid by a pipette.

e Use an alcohol-soaked pledget around the stopper and needle when removing a syringe and needle from a rubber-stoppered bottle.

f Use only needle-locking hypodermic syringes.

g Expel excessive fluid and bubbles from a syringe vertically into a cotton pledget soaked with disinfectant or into a small bottle of cotton.

h Before and after injection of an animal, swab the site of infection with a disinfectant.

i Sterilize discarded pipettes and syringes in the pan in which they were first placed after use.

j Before centrifuging, inspect tubes for cracks. Inspect the inside of the trunnion cup for rough walls caused by erosion or adhering matter. Carefully remove all bits of glass from the

rubber cushion. A germicidal solution added between the tube and the trunnion cut not only disinfects the surface of both, but also provides a cushion against shocks that otherwise might break the tube.

k Use centrifuge trunnion cups with screw caps or equivalent.

l Avoid decanting centrifuge tubes. If you must decant, afterwards wipe off the outer rim with a disinfectant. Avoid filling the tube to the point that the rim becomes wet with culture.

m Wrap a lyophilized culture vial with disinfectant-wetted cotton before breaking.

n Never leave a discarded tray of infectious material unattended.

o Sterilize all contaminated discard material.

p Periodically clean Deepfreeze and Dry Ice chests in which cultures are stored to remove any broken ampoules or tubes. Use rubber gloves and respiratory protection during this cleaning.

q Use rubber gloves when handling diagnostic serum specimens carrying a risk of infectious hepatitis.

r Develop the habit of keeping your hands away from your mouth, nose, eyes, and face. This may prevent self-inoculation.

s Avoid smoking, eating, and drinking in the laboratory.

t Make special precautionary arrangements for oral, intranasal, and intratracheal inoculation of infectious materials.

u Give preference to use of operating room gowns fastening at the back.

v Evaluate the extent to which hands may become contaminated. With some agents and operations, forceps or rubber gloves are advisable.

w Wear only clean laboratory clothing in the dining room, library, etc.

x Shake broth cultures in a manner that avoids wetting the plug or cap.

4 Personnel Indoctrination and Training

All personnel should be oriented with respect to the existence of and need for general and specialized safety program requirements for a laboratory. Support personnel (secretaries, janitors, maintenance men, etc.) should be allowed to enter areas where biological agents are worked with only when needed to provide specific services. Such entry should always be authorized by the scientist in charge of the work under way in the unit involved; individuals authorizing entry to potentially contaminated areas of a laboratory should prescribe procedures to be followed (clothing and footwear required, use of safety equipment, etc.) when entering, working within, or leaving such areas.

Individuals assigned to units involved in work in microbiology, biochemistry, or radiology should receive instructions based upon specific job assignments. Indoctrination programs for new employees should identify potential hazards of all job assignments, as well as approved procedures for their prevention and control. Pertinent information concerning the biological characteristics of agents being studied should take into consideration the host range, pathogenicity for man and animals, mode of spread, and methods of inactivation or decontamination. Individuals assigned to chemistry units or groups employing radioactive materials should be oriented with respect to the potential hazard of the material and trained in the proper techniques for their handling and storage, as well as the proper use and maintenance of protective devices routinely employed in the work.

Specialized instructions should be designed to assist in the development of reliable employees whose conduct affords a maximum of protection to themselves, their fellow employees, and the continuity of the programs they are engaged in.

T BIOHAZARDS AND THEIR CONTROL IN THE LABORATORY (Continued)

5 Disease Transmission in the Laboratory

Laboratory infections generally result from (1) oral exposure, (2) respiratory exposure, (3) conjunctival exposure, (4) skin puncture, or (5) penetration through the unbroken skin.

a Oral Exposure

Oral exposure can occur any time a contaminated object is placed in the mouth. Nothing should be placed in the mouth in areas where biohazards are present. This includes food, drink, cigarettes, and fingers. Such activities as mouth pipetting should be prohibited at all times. Sulkin and Pike[3] cite 33 pipetting exposures from a total of 216 laboratory accidents.

b Respiratory Exposure

When an infection occurs and no known contact with the infection agent has occurred, it is generally assumed to be due to an aerosol exposure. This is especially true in hospital and laboratory environments. Almost all laboratory activities can generate aerosols of

small particle size. Particles in 2-3 micrometer size range have been shown to have low settling velocities and can remain suspended for long periods of time. These small particles are capable of penetrating to the deep regions of the lungs.

c Conjunctival Exposure

Conjunctival explosure has been reported with adenovirus, Newcastle disease virus, and vesicular stomatitis virus.

d Skin Puncture

Autoinoculation is one of the most common laboratory accidents. Cuts with contaminated glassware have also been reported. Abrasions of the skin with contaminated grinding compound have resulted in infection. Autopsy and surgical instrument cuts have resulted in infections.

T BIOHAZARDS AND THEIR CONTROL IN THE LABORATORY (Continued)

e Penetration Through the Unbroken Skin

Some microorganisms are capable of penetrating the unbroken skin of man. Brucella suis, Brucella abortus, and Francisella tularensis appear to have this ability.

Reports by Stein and Segrave[4] and Sulkin and Pike[5] revealed that many laboratory infections result from accidents or poor techniques. However, in most cases the mode is not known. In one report by Sulkin[6], only 16 percent of the laboratory infections could be traced to a known cause. Exhaustive on-the-spot investigations of 90 laboratory acquired illnesses at Fort Detrick could only reduce the unknown group to 65 percent[7]. Many times it was known only that the individual had worked with the agent or tended infected animals.

Another important factor pointed out by Sulkin is that laboratory infections do not always follow the pathway of transmission established for the naturally-occurring disease.

There is a preponderance of evidence in the literature that indicates that if the traceable causes of laboratory infections are eliminated, the remaining can be considered due to aerogenic transmission.

Wedum[2] points out that common laboratory procedures using an inoculating needle, pipette, syringe, centrifuge, lyophilizer and blender create aerosols laden with infectious agents of particle size suitable for infection by inhalation. Air samples collected within 2 feet of the work area contain varying numbers of organisms, depending on the work being performed. Air samples collected at the time a Waring blender cover was removed after mixing a culture contained too many organisms to count. Eighty-six organisms were collected when a lyophile culture tube was opened. Decanting centrifuged fluid into a flask produced 17 airborne organisms. Inserting a hot loop into a culture flask produced 9 airborne organisms.

Laboratory accidents also liberate many organisms into the air. Table 1, from Wedum[2] presents some typical laboratory accidents and the airborne organisms they liberate. Table 2, from the same source, presents some single source multiple infections from known laboratory accidents.

Table 1

Bacteria Recovered by Air Sampling

During Common Laboratory Accidents

Colonies

Obtained

per

Accident Accident

One 50-ml. tube breaking in centrifuge and culture

splashing side of centrifuge; air sampled 7 inches

(18 cm) above centrifuge 1,183

One 50-ml. tube breaking in centrifuge but all 30 ml.

of culture staying in trunnion cup 4

Accidentally breaking one ampoule of lyophilized

nutrient broth culture on floor; air sampled at nostril height, 18 inches (46 cm) each side of accident site,

for 1 hour. 491

Drop of culture falling 12 inches (30 cm) onto steel

surface; air sampled within 2 (61 cm) feet of site 16

Petri plate cultures dropped on floor; air sampled 4 feet

(1.2 m) above floor, 70 feet (21.3 m) from accident 9

From Wedum[2].

Table 2

Episodes of Single-Source Multiple Laboratory

Infections Persons Infected

Probable Source Maximum Distance Number

Disease of Infection From Source Infected

Brucellosis (8) Centrifugation Basement to 94

third floor

Coccidioido- Culture transfer, 2 building floors 13

mycosis (9) solid media

Coxsackie virus Tube of infected 5 feet (estimated) 2

infection (10) mouse tissue (1.5 m)

spilled on floor

Louping ill virus Intranasal 2 feet (estimated) 3

infection (11) inoculation of (61 cm)

mice

Murine Typhus (12) Intranasal 6 feet (estimated) 6

inoculation of (1.8 m)

mice

Q fever (13) Centrifugation 1st floor to 3d floor 47

Tularemia (14) 20 petri plates 70 feet (21.3m) 5

dropped

Venezuelan 9 lyophilized 4th floor stairs to 24

encephalitis (15) ampoules dropped third and fifth

Note: Numbers in parentheses are references.

Modified from Wedum[2].

f Biological Laboratory Safety Equipment

The primary objective of all biological laboratory safety equipment is to break the chain of events which may eventually result in unwanted infection of laboratory personnel or animals. This may be done by control of specific operation or technique being performed at the bench-top level (automatic pipetting devices, safety centrifuge cups and blenders,

T BIOHAZARDS AND THEIR CONTROL IN THE LABORATORY (Continued)

etc.) by containment systems which confine hazardous work to gas-tight cabinets or cages (16) (biological hoods, ventilated cages, etc.) or by use of personal protection equipment (respirators, gas masks, ventilated hoods, or suits) when containment is impractical. The use of autoclavable, heat-sealable, pliable plastic materials for isolating the laboratory worker from equipment harboring infectious material offers substantial advantages at minimal equipment cost.

The following equipment and techniques have been designed to facilitate greater laboratory safety.

A modification of the high speed blender is described by Reitman et al.[17]. If properly used, this blender will eliminate the hazard associated with the high speed blending of infectious material.

Hazards associated with the centrifuge result from either tube breakage or loss of stoppers resulting in the production of infectious aerosols. Whitwell et al.[18] also found that an infectious aerosol was produced when contaminated fluid was left in the threads during centrifugation. Safety trunnion cups have been developed to eliminate this hazard.

Mouth pipetting should be discouraged even when handling noninfectious material. If the habit of mouth pipetting is practiced, the likelihood of inadvertently pipetting by mouth with infectious agents is greater. Any pipetting procedure conducted in a safety cabinet would, of course, require the use of a pipetting device.

Many laboratory accidents have been associated with the use of the hypodermic syringe and needle. Some examples are: (1) separation of the needle from the syringe during injection, (2) aerosol formation when needle is withdrawn from the vial, (3) spray formation resulting from skin puncture during an interdermal exposure, and (4) hand contamination resulting

from leakage of inoculum from inoculated embryonated eggs.

The use of an inoculating loop can be a hazardous bacteriological procedure. Anderson et al.[19] demonstrated that when a cold inoculating loop was inserted into a 250 ml. Erlenmeyer flask of culture, 0.8 organisms were recovered from the air per operation. However, if the loop was hot, 8.7 organisms were recovered from the air per operation. Spattering of the infectious organisms when the loop is flamed is also a potential source of laboratory infection. Microincinerator units used for sterilizing contaminated culture loops are available to reduce the danger of spattering infectious organisms.

Lyophilization procedures often predispose to laboratory infection. When vacuum is applied, the contaminated air is withdrawn from the ampoules through the pump and into the room. By the use of HEPA air filters or air decontamination procedures, this hazard can be greatly reduced. Aerosols are also often created by opening lyophilized ampoules. When the vacuum is released, the rushing air may cause a fine aerosol to escape into the room. This hazard may also be greatly reduced by wrapping the ampoule in a disinfectant-soaked pledget of cotton before breaking.

Such protection measures as: (1) use of Lur-Loc syringes, (2) eye protection, (3) respiratory protection, and (4) use of alcohol-saturated pledget of cotton at puncture of needle and inoculum vial should be used when warranted.

Biological safety cabinets are the principal equipment used to provide physical containment. They are used as primary barriers to prevent the escape of aerosols into the laboratory environment. Some cabinets also protect the experiment from airborne contamination. A

biological safety cabinet should be selected on the basis of the hazard of the agent, the potential of the laboratory technique to produce aerosols and the need to protect the experiment from airborne contamination.

Three classes of biological safety cabinets are used in the microbiological laboratory: the Class I, Class II, and Class III cabinets.

o Class I Cabinet

The Class I Cabinet is a ventilated cabinet that may be used in the three operational modes: with a full-width open front, with a front closure, and without gloves, and with front closure panel with gloves. Protection is provided to the user and the environment but not to the product.

o Class II Biological Safety Cabinet

The Class II Biological Safety Cabinet is commonly known as a laminar flow biological safety cabinet. Class II cabinets have a front opening for access to the work space and for introducing and removing materials. Airborne contaminates in the cabinet are prevented from escaping across this opening by a curtain of air formed by (1) unfiltered air flowing from the room into the cabinet and (2) HEPA filtered air supplied from the overhead grille in the cabinet. This curtain of air also prevents airborne contaminants in the room from entering the work space of the cabinet. All of the air which enters the cabinet through the front opening as well as the air recirculating in the cabinet is drawn into a positive pressure plenum. The same amount of air that is drawn into the cabinet through the front opening is exhausted from the cabinet through a HEPA filter. This air may be exhausted to the room or outside the building. The balance of the air is HEPA filtered and flows through the overhead grille to the cabinet work area thus maintaining a clean-air work environment.

Class II cabinets are available in two basic types--A and B. Type selection should be based on the work to be accomplished. A biological safety cabinet with the characteristics of a Class II but which exhausts 100% of the air has recently become

available. This unit is particularly useful for biological experiments which utilize toxic or flammable chemicals.

o Class III Biological Safety Cabinet

The Class III Biological Safety Cabinet is a totally enclosed ventilation cabinet of gas-tight construction. Work within the Class III cabinet is accomplished through attached rubber gloves. The Class III operates under a negative pressure of at least 0.5 inches water gauge. Both supply and exhaust air are HEPA filtered.

Materials are introduced into the cabinet through a double door sterilizer or liquid disinfectant filled dunk tank. The Class III cabinet provides the highest level of personnel, environmental, and product protection of any cabinet system. Detailed information concerning the three classes of biological safety cabinets can be obtained by contacting the equipment manufacturer.

6 Handling Laboratory Animals

Proper methods of restraint should be used when handling and exposing laboratory animals. Improper restraining methods often result in pain to the animal, as well as scratches or bites to the handling personnel. Devices for holding rabbits, rats, mice, monkeys, etc. are available and should be used. Safety gloves should be used when handling monkeys and in some cases when handling dogs and cats.

Animal caging should be designed to minimize the possibility of exposure of personnel as well as other animals. Two types of high security animal cages have been designed. The ventilated type developed at Fort Detrick[2] utilizes high efficiency supply and exhaust filters and a negative pressure, forced ventilation system. Kraft type cages[21] utilize a high efficiency diffusion type

filter and rely on diffusion of air through a large surface area filter.

Humane methods of euthanasia should be employed when disposing of laboratory animals. Necropsy procedures should minimize the danger of cross infection. When possible, dead animals should be incinerated. Care must be taken when incinerating contaminated animal carcasses. Although preheating the incinerator assures sterility of smoke and vapor released into the atmosphere, charging preheated incinerator with highly contaminated materials may liberate large quantities of contaminated smoke or vapor into the charging room.

7 References

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U MEDICAL/INFECTIOUS WASTE MANAGEMENT

Consult with the Biological Safety Officer or SHEMB, depending on the issue.

V RADIOLOGICAL PROGRAM

Consult with the Radiological Safety Staff for guidance.

W RADIOLOGICAL AND MIXED WASTES MANAGEMENT

Consult with the RSS or SHEMB, depending on the issue, for guidance.

X EXHIBITS

1 List of Environmental Standards

Exhibit 1

List of Environmental Standards Executive Orders

Executive Order (EO) 12088, Federal Compliance with Pollution Control Standards.

EO 11514, Protection and Enhancement of Environmental Quality.

EO 12372, Intergovernmental Review of Federal Programs.

EO 11990, Protection of Wetlands.

EO 11988, Floodplain Management.

EO 12580, Superfund Implementation.

EO 11989, Off-Road Vehicles on Public Lands.

EO 11987, Exotic Organisms.

EO 12114, Environmental Effects Abroad of Major Federal Actions.

EO 12549, Debarment and Suspension.

EO 12780, Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy.

Major Statutes.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4341 et seq.

Resource Conservation and Recovery Act (RCRA), as amended, 42 U.S.C. 6901 et seq.

Solid Waste Disposal Act, as amended, 42 U.S.C. 6961

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, aka Superfund), as amended, 42 U.S.C. 9601 et seq.

Emergency Planning and Community Right-to-Know Act of 1986, Public Law (PL) 99-499.

Pollution Prevention Act of 1990, PL 101-508.

The Clean Air Act, as amended, 42 U.S.C. 7410 et seq.

Federal Water Pollution Control Act (aka Clean Water Act), as amended, 33 U.S.C. 1251 et seq.

Exhibit 1 (Continued)

List of Environmental Standards Executive Orders (Continued)

Oil Pollution Act of 1990, PL 101-380.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, 7 U.S.C. 136 et seq.

Toxic Substances Control Act (TOSCA), as amended, 15 U.S.C. 2601 et seq.

Safe Drinking Water Act (SDWA), as amended, 42 U.S.C. 300f et seq.

Endangered Species Act (ESA), as amended, 16 U.S.C. 1531 et seq.

National Historic Preservation Act of 1966, 16 U.S.C. 470 et seq.

Archaeological and Historic Preservation Act of 1974, 16 U.S.C. 469 et seq.

Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa et seq.

Native American Graves Protection and Repatriation Act of 1990, 25 U.S.C. 3001 et seq.

Intergovernmental Cooperation Act of 1968, 42 U.S.C. 4231 et seq.

Environmental Quality Improvement Act of 1970, as amended, 42 U.S.C. 4374 et seq.

Rivers and Harbors Act of 1899, 33 U.S.C. 401 et seq.

Federal Facilities Compliance Act of 1992, amendment of Solid Waste Disposal Act

Major Implementing Regulations.

National Environmental Policy Act, 7 CFR 1b (USDA NEPA regulation).

National Environmental Policy Act - Implementation, 7 CFR 520 (ARS NEPA regulation).

Council on Environmental Quality Regulations on Implementing National Environmental Policy Act Procedures, 40 CFR 1500-1508.

EPA General Regulations for Hazardous Waste Management, 40 CFR 260.

EPA Regulations for Identifying Hazardous Waste, 40 CFR 261.

Exhibit 1 (Continued)

List of Environmental Standards Executive Orders (Continued)

EPA Regulations for Hazardous Waste Generators, 40 CFR 262

EPA Regulations for Hazardous Waste Transporters, 40 CFR 263.

EPA Regulations for Owners and Operators of Permitted Hazardous Waste Facilities, 40 CFR 264.

EPA Interim Status Standards for Owners and Operators of Hazardous Waste Facilities, 40 CFR 265.

EPA Standards for Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities, 40 CFR 266.

EPA Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities, 40 CFR 267.

EPA Regulations on Land Disposal Restrictions, 40 CFR 268.

EPA Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks, 40 CFR 280.

Department of Transportation Hazardous Materials Regulations, 49 CFR, Chapter I, Subchapter C.

Nuclear Regulatory Commission Standards for Protection Against Radiation, 10 CFR 20.

U.S. Fish and Wildlife Service (USFWS) Regulations on Endangered and Threatened Wildlife and Plants, 50 CFR 17.

(USFWS) List of Endangered Species, 50 CFR 17.11.

EPA National Oil and Hazardous Substances Pollution Contingency Plan Under CERCLA, 40 CFR 300.

EPA Designation, Reportable Quantities, and Notification Requirements for Hazardous Substances Under CERCLA, 40 CFR 302.

EPA Regulations for Emergency Planning and Notification Under CERCLA,

40 CFR 355.

EPA Hazardous Substance Reporting Requirements for Selling or Transferring Federal Real Property, 40 CFR 373.

Federal Property Management Regulations, 41 CFR 101.

Exhibit 1 (Continued)

List of Environmental Standards Executive Orders (Continued)

EPA Hazardous Chemical Reporting and Community Right-to-Know Requirements, 40 CFR 370.

EPA Toxic Chemical Release Reporting Regulations, 40 CFR 372.

EPA Regulations Governing Citizen Awards for Information on Criminal Violations Under Superfund, 40 CFR 303.

Department of the Interior Natural Resource Damage Assessments, 43 CFR 11.

EPA Guidelines for Federal Procurement of Lubricating Oils, 40 CFR 252.

EPA Guidelines for Federal Procurement of Paper and Paper Products Containing Recovered Material, 40 CFR 250.

EPA Regulations on Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR 257.

EPA Criteria for Municipal Solid Waste Landfills, 40 CFR 258.

EPA Regulations on National Emission Standards for Hazardous Air Pollutants, 40 CFR 61.

EPA Regulations on Discharge of Oil, 40 CFR 110.

EPA Regulations on Oil Pollution Prevention, 40 CFR 112.

EPA Interim Regulations on Civil Penalties for Violations of Oil Pollution Prevention Regulations, 40 CFR 114.

EPA National Pollutant Discharge Elimination System Permit Regulations, 40 CFR 122.

EPA Interim Regulations on Discharge of Dredged or Fill Material into Navigable Waters, 40 CFR 230.

Coast Guard Regulations on Oil Spills, 33 CFR 153-158.

EPA Regulations on Designation of Hazardous Substances, 40 CFR 116.

EPA Regulations on Determination of Reportable Quantities for Hazardous Substances, 40 CFR 117.

Army Corps of Engineers Permit Program Regulations, 33 CFR 320-330.

Exhibit 1 (Continued)

List of Environmental Standards Executive Orders (Continued)

EPA Regulations on Criteria and Standards for the National Pollutant Discharge Elimination System, 40 CFR 125.

EPA Pretreatment Standards, 40 CFR 403.

EPA Regulations on Test Procedures for the Analysis of Pollutants, 40 CFR 136.

EPA National Primary Drinking Water Standards, 40 CFR 141.

EPA Primary Drinking Water Implementation Regulations, 40 CFR 142.

EPA National Secondary Drinking Water Standards, 40 CFR 143.

EPA Permit Regulations for the Underground Injection Control Program,
40 CFR 144.

EPA Criteria and Standards for the Underground Injection Control Program, 40 CFR 146.

EPA Regulations on Review of Project Affecting Sole Source Aquifers,
49 CFR 149.

EPA Effluent Guidelines and Standards for Feedlots, 40 CFR 412.

Subchapter E - Pesticide Programs, 40 CFR 150-180.

Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions, 40 CFR 761.

29 CFR 1910.120, OSHA Standards for Protection of Workers at Hazardous Waste Sites.

EPA Worker Protection Regulations, 40 CFR 311.

Protection of Historic Properties, 36 CFR 800.

National Register of Historic Places, 36 CFR 60.

Waiver of Federal Agency Responsibilities Under Section 110 of the National Historic Preservation Act, 36 CFR 78.

Protection of Archaeological Resources, 43 CFR 7.

Exhibit 1 (Continued)

List of Environmental Standards Executive Orders (Continued)

Major Federal Policies.

EPA Statement of Policy on Protection of Nation's Wetlands.

EPA Interim Guidance for Hazardous Substance Removal Under CERCLA.

EPA Policy on Environmental Auditing.

EPA/NRC Guidelines on Identification of Low-level Radioactive and Hazardous Waste.

EPA Guidelines for Federal Procurement of Products Containing Recovered Materials.

EPA Pollution Prevention Policy.

CEQ Questions and Answers on NEPA Regulations.

CEQ Scoping Guidance. (Primarily for EIS's.)

EPA Interim Guidance on Settlements with de minimis Waste Contributors Under CERCLA.

EPA Interim Model for CERCLA _de minimis_ Waste Contributor Settlements.

EPA Federal Agency Hazardous Waste Compliance Docket.

Other Applicable Guidance.

Departmental Manual 5600-1, Environmental Pollution Prevention, Control, and Abatement Manual

OMB Circulars A-106 and A-11

State and local laws, ordinances, implementing procedures, etc. that are equivalent to Federal ones and generally applicable

ARS Directive 600.12, Guidelines and Precautions to be Taken by Personnel in Storing, Using, Handling, and Disposing of Agricultural Chemical Pesticides

Departmental Regulation (DR) 4400-2, Hazard Communication Programs

DR 5023-1, Chemical Hazard Communication

ARS Facilities Design Manual

Exhibit 1 (Continued)

List of Environmental Standards Executive Orders (Continued)

ARS ARMP Manual

ARS CRIS Manual

EPA Policy on Environmental Auditing

EPA/NRC Guidance on Identification of Low-Level Radioactive and Hazardous Waste

EPA Radiation Protection Guidance

EPA Standards for Tracking and Managing Medical Wastes, 40 CFR 259

EPA Guidelines for Federal Procurement of Building Insulation Products Containing Recovered Materials, 40 CFR 248

EPA Guidelines for Procurement of Products that Contain Recycled Materials, 40 CFR 247

EPA Guidelines for Procurement of Cement and Concrete Containing Fly Ash, 40 CFR 249

EPA Guidelines for Procurement of Federal Procurement of Retread Tires, 40 CFR 253

EPA Policy Guidance on Implementation and Enforcement of the Lead Prohibition and Public Notice

Requirements Under the Safe Drinking Water Act

EPA Policy for Listing Federal Facilities on the National Priorities List for Uncontrolled Hazardous Waste Sites

EPA Clarification of RCRA Regulatory Status of Chlorofluorocarbons Used as Refrigerants

EPA Clarifications on Toxicity Characteristics

EPA Guidelines for Federal Procurement of Products Containing Recovered Materials

EPA Enforcement Authority Guidance Under Section 122(r)(9) of the Clean Air Act

EPA Guidelines on Federal Agency Compliance with Stationary Source Air Pollution Standards

Exhibit 1 (Continued)

List of Environmental Standards Executive Orders (Continued)

Water Resources Council Principles and Standards for Planning Water and Related Land Resources

EPA Guidelines on Design, Operation, and Maintenance of Wastewater Treatment Facilities

EPA Guidelines on Operation and Maintenance of Wastewater Treatment Facilities

CEQ Memorandum on Implementation of NEPA Regulations

EPA Interim Interpretation and Policy Statement on Notification Requirements Under CERCLA

EPA Memorandum on Criteria for Determining Recyclable Hazardous Waste

EPA Interim Guidance on Settlements with "de minimis" Waste Contribution Under CERCLA

EPA Interim Model for CERCLA "de minimis" Waste Contributor Settlements

EPA Memorandum on Enforcement Actions at Federal Facilities Under RCRA and CERCLA

EPA Dispute Resolution Schedule for Federal Facility Compliance Under RCRA

EPA Guidance on Landowner Liability Under Section 170(a)(1) and "de minimis" Settlements Under Section 122(g)(1)(B) of CERCLA, and Settlements with Prospective Purchasers of Contaminated Property